Figure 1:

Amino acid sequences of Cpn60 and Cpn10:

SEQ ID No 1: Cpn10 (encoded by nucleotides pos. 458-751 of Figure 2):

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEKPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 2: Cpn60 (encoded by nucleotides pos. 800-2446 of Figure 2):

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSVA
REIELKDKFENMGAQMVKEVASQANDQAGDGTTTATVLAQAIISEGLKSVAAGMNP
MDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKVG
KEGVITVEEGKGLEDELDVVEGMQFDRGYLSPYFINNQEKMTVEMENPLILLVDKKI
DNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGDR
RKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEASV
NTRVDQIRAEIESSTSDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVDDA
LHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQIAGN
AGAEGSVVVDKVKSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASIAGL
MITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

Figure 2:

SEQ ID No 3: DNA coding for Cpn60 and Cpn10:

Cpn10, pos. 458-751
Cpn60, pos. 800-2446

atcaaaaaatgcagcaaggacagattcctgcccaagaattagcagaaggtttcttgttagcactggccggcgctttattattaacgccgg
gttttgtcactgatgcgctgggttttacattactcgtccccgcgacgcgtaaagcgttggtccataaggtgattgcatttattacccctc
gcatgatgactgcaagcagctttcaagcgacgggtagttttcaggaaggctcgtttaaagatgtacattcgcacactgactcgcaaagca
gtcatgaaaaaatcacaattgaaggcgaatataccaaagacgataagtaggtattttttcggctagccgttgaaatcctagtaaaagccc

cgataaattaaccatctatttttcacagaggcaatttagcctttgtttaccttattgatcctaatacttgggatccaacagttggagagtctagc

aaatgaaaatccgtccattacatgatcgtattgttgttcgccgtaaagaagaagagaccgcaactgcgggtggtattattttacc

gggcgctgcggcagaaaaaccaaatcaaggtgttgttatctctgtgggtactggccgtattcttgataatggttcagtgcaagcgctggc

ggttaacgaaggcgatgttgtcgtttttggtaaatactcaggtcaaaatactatcgatatcgatggtgaagaattattgattttgaatga

aagtgatatctacggcgttttagaagcttaattattacactcactttttatttaacctacaaaatttaaggaaagatcatggctgctaaagacg

tattatttggtgatagcgcacgcgcaaaaatgttggtaggtgtaaacattttagccgacgcagtaagagttaccttaggacctaa

aggtcgtaacgttgttatagaaaaatcatttggtgcaccgatcatcaccaaagatggtgtttctgttgcgcgtgaaatcgaattgaaagaca

aattcgaaaacatgggcgcacagatggttaaggaagttgcttctcaagccaacgaccaagccggtgacggcacaacgacagcgactg

tactagcacaggcgattatcagcgaaggcttgaaatctgttgcggctggcatgaatccaatggatcttaaacgtggtattgataaagctac

ggctgctgttgttgccgccattaaagaacaagctcagccttgcttggatacaaaagcaatcgctcaggtagggacaatctctgccaatgc

cgatgaaacggttggtcgtttaattgctgaagcgatggaaaaagtcggtaaagaaggtgtgattaccgttgaagaaggcaaaggccttg

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aaatggaaaatccattaattctattggttgataagaaaattgataaccttcaagagctgttgccaattcttgaaaacgtcgctaaatcaggtc

gtccattattgatcgttgctgaagatgttgaaggccaagcactagcaacattggtagtaaacaacttgcgcggcacattcaaggttgc

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ctagggatgtctttagaaactgcggatccttcttcttctttgggtacggcaagcaaggttgttatcgataaagaaaacaccgtgattgttga

tggcgcaggtactgaagcaagcgttaatactcgtgttgaccagatccgtgctgaaatcgaaagctcgacttctgattacgacatcgaaaa

gttacaagaacgcgttgctaagcttgcggggcggcgttgccgtgattaaggttggtgcgggttctgaaatggaaatgaaagagaagaaa

gaccgtgttgacgatgcacttcatgcaactcgcgcagcggttgaagaaggtgttgttgcgggtggtggtgttgctttgattcgcgcactct

cttcagtaaccgttgttggtgataacgaagatcaaaacgtcggtattgcattggcacttcgtgcgatggaagctcctatccgtcaaatcgc

gggtaacgcaggtgctgaagggtcagtggttgttgataaagtgaaatctggcacaggtagctttggttttaacgccagcacaggtgagt

atggcgatatgattgcgatgggtatttttagaccctgcaaaagtcacgcgttcatctctacaagccgcggcgtctatcgcaggtttgatgat

cacaaccgaagccatggttgcggatgcgcctgttgaagaaggcgctggtggtatgcctgatatgggcggcatgggtggaatgggcgg

tatgcctggcatgatgtaatcactttgtgattcattgtcctgatctgcttaccgtgtaaaaagatcaggctcaaggctgtctctataaaaagcc

gtatctttgatgagtgttgtctttctgctgaaaacgacattcttggagtgcggctttttttgattttggtcataaaattcagaatattgtgtaatttta

tgtaactagctggcctataatgttgagttcctctgggtggcatgatctcatggtacttcacttaagcctgattcactgcg

gctttaacagtaaaataataacgcaacgtagaaacataataagcgtatggcattaatgaagacggctgcatttaattcagatc

Figure 3:

SEQ ID No 4: Amino acid sequence of esterase cloned from _Oleispira antarctica_ (EstRB8):

EstRB8 (encoded by nucleotides 1145 to 2143 Frame 2 of Figure 4) 333 aa

MKNTLKSSSRFSLKQLGTGALIISSLFFGGCTTTQQDNLYTGVMSLARDSAGLEVKTA
SAGDVNLTYMERQGSDKDNAESVILLHGFSADKDNWILFTKEFDEKYHVIAVDLAG
HGDSEQLLTTDYGLIKQAERLDIFLSGLGVNSFHIAGNSMGGAISAIYSLSHPEKVKSL
TLIDAAGVDGDTESEYYKVLAEGKNPLIATDEASFEYRMGFTMTQPPFLPWPLRPSLL
RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVLD
VSAAAAFKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 4:

SEQ ID No 5: DNA fragment from plasmid pBK1Est coding for esterase of *Oleispira antarctica* (EstRB8):

Nucleotide positions 1-100 correspond to reverse complement of positions 1196-1121 and 3799-3939 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene).

Positions 101-105 are *BamH*I – *Sau*3A1 fusion and positions 3795-3798 are *Sau*3A1-*Bam*HI-fusion.

acaggaaacagctatgaccttgattacgccaagctcgaaattaaccctcactaaagggaacaaaagctggagctcgcgcgcctgcag

gtcgacactagtggatcaacggcgttcatggtactggctgagttcagcgtcataatgccgatgcgatactggccgtcatgactgagtact

tcttctgctagcaccgattttctaatagcgcagcttctttatttctgaacgggcaactgatgtagttttttttactaaccggcttttttaggcatgg

taaactcttcgatattcaaaattattactgttcatattacaatcatagtacaggctagaggcccaaaattgcagctgatattcacctttattattc

taagcattattacactcatcgcggtgttattaattgtgctaaataaaaatacccgtagcggaaaaattcagcaaatagccaaagaaaacga

ttggcaataccaagaattcatcgattttgatgatgacattaagcaggcaaactttggcctattaaactacagtcaaaatgcaattttagacat

ctcattcaagcaactgacgaacactatggcttagcgtttaagacctttgactgtcgagcgttagaaccttcaggtattcacaatagcagtctt

attttatttaccctcgcactaaagactgaattcaataacctacacatttgcttaagtcgacatattcaagataaagatgccttcactgacatca

gtcaccaacaatcaatcaaacaccaataccaatcgcaaaaactcataaaactagccgatcaccaaatcccaaaagcgttcaaaaatgaa

acgagcacgtcacacaaatcaatttatacgctaacgaaccaggtcaaacttatcgttttttgagcacgtttgttccactaatgaaagaga

aaagtcgttaattcactggcttttggcgtatccgcaccttcacatagaaattagtaatggcatgctactggcctttaaaaagaatcagttaatt

gaagaaacctcgcttatctcagccattaccgctgtagccgaatttgcgcttatcctcagccatgattaaactgacgccaattaatataagac

atactaattaataactcccttaattgagaagaataatgaaaaacacactcaaatcctcatcacgttttagtctgaaacaactcggcaccggc

gctctgattatctccagtttgttcttcggtggttgcaccacaacacaacaagataatttatacacaggggttatgtctcttgcgagagacagc

gctggcctagaagttaaaacagcctctgccggtgacgtcaatcttacttatatggaacgccaaggcagtgacaaagataatgccgaaag

cgttattttattacacggtttctctgctgataaagataactggattcttttaccaaagaattcgatgaaaaatatcatgttatcgctgtcgattta

gcgggacatggcgattcagaacaattattaacgactgattacggtctcataaaacaagccgagcgtttagatatcttcttatctggcttagg

ggttaactcatttcacatcgccggtaattcaatggggggggggctatcagcgcaatctacagtttgagtcacccagagaaagttaaaagtctt

acattgatcgatgcagcaggtgtcgatggcgatactgaaagcgaatactacaaagttttggcagaaggtaagaatcctttaattgcaact

gatgaagcaagttttgaataccgcatggggtttcaccatgactcagcctcctttcctaccttggccactaagaccttctttattacgtaaaacg

ctagcccgtgccgagatcaataacaaaattttttccgatatgctgaaaaccaaagaacgtttaggaatgactaactttcaacagaaaattg

aagtgaaaatggctcaacatccattgccaacactgattatgtggggcaaagaagatcgcgttcttgacgtatccgcagcagcggccttc

aaaaaaataattccacaagcaactgttcatattttcctgaagtaggccacctacctatggtagaaattcctagtgaaagcgctaaagtttat

gaagagtttttgtcctctattaaataagagcacataatcatgactgacttataaacagccaagcatttaaaatgcttggctgtttattttaatgg

ccaaattattcaacgaccaagctctgcggtaaaatcgcagtgggtttcttgttttcatcaacagcaacaaacgtgaaataccccgtaatcg

cattttctgattatcaaaatacatactttccaccagcatattaacttcaacttttaaactcgtccgccctacctctataacactggcagtcaatt

cgacaatggtacctgcgggaacaggatgcttaaaatcgattcgatcactgctgacggttacgatgctttgtcgagaaaaacgagtcgct

gcaataaaagaaacctcatccatccactgcattgcagtgccaccgaataacgtatcatgatgatttgttgtctctggaaataccgctttaga

aatagtggttttttgatacgcgctttcgctgcgcaataatatcttctctgctaagagttgcggatggcatacataaactcgcttgattaagatta

ataataaatagttaacagtatattgaactgagggtctgaagaactctaatacctctgaagaactttgaggccgctagagagaaaagacca

gtgataatatttcatcttgccatgagagcttatcatgaaagcctgtgcttaaaatcaatcattatatttattcatctttaattgaaataataccaat

atatttcatatataatttcacactacccttatctcactagacttcccgcgcataggcgcaaacaatcaacgcaagttcacaataaagcggttc

gctgcaacacatgccctagcgtctaaagtagcacgcacaacactggccagtcgtactagcccctttgcgattcgtgcagacgagcaac

aagcgctattaaacttacctaaatttctaaccaccaccattggttcttttccacaaactcaaaaaactcgtcaaatccgcttgcaatttaaacg

cgatgacatagatctaatcgattatcaaacccgcattcaagcgctcattaaaaacgcaccactggcaagaagttctacctgcactgacca

atatgcaagcggcggcggaagagctgcctttgatcgatcaagaagaagggagcagcaaagaggaaaacaatcaaaaagaggagag

caatcaaataaaaacgagttattgaggattttaattttaaaacaggtatattaataccctctctcgtagtaaacaatgactgtatttacacaaaa

ataaatagaggtataccatgtcaaacatctggtttgaagtaccaaagattgaagtattaaaccgtcaaatggaaaatactgcctgcagcaa

cttaggcattcaaattacagaaattggcgatgattatatcactggcacaatgccagcagatgcacgtaccttccagccaatgggactgatt

catggcggctcaaatgtattgctggcagaaacactgggcagcatggcagctaactgctgtattaatttgtctcaagaatattgtgttggcc

aagaaattaacgccaaccacatacgcggtgttcgttccggcatagtgactggcacagcaacgctagtacacaaaggaagaacctccca

gatttgggaaattcgcatcgttaacgatccaaagaattcaaaaagcttctcgagagtacttctagagcggccgcgggcccatcgattttcc

acccgggtggggtaccaggtaagtgtacccaattcgccctatagtgagtcgtattacaattcactggccgtcgttttac

Figure 5:

Amino acid sequences expressed from vector pBK1CpnEst: - the co-expression of fragments encoding native chaperonines with the esterase gene (EstRB8), all from *Oleispira antarctica*

SEQ ID No 6: cpn10 (nucleotides 113 to 403: Frame 2 of Figure 6) 97 aa:

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEKPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 7: cpn60 (nucleotides 455 to 2098: Frame 2 of Figure 6) 548 aa:

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSVA
REIELKDKFENMGAQMVKEVASQANDQAGDGTTTATVLAQAIISEGLKSVAAGMNP
MDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKVG
KEGVITVEEGKGLEDELDVVEGMQFDRGYLSPYFINNQEKMTVEMENPLILLVDKKI
DNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGDR
RKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEASV
NTRVDQIRAEIESSTSDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVDDA
LHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQIAGN
AGAEGSVVVDKVKSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASIAGL
MITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

SEQ ID No 8: estRB8 (nucleotides 2579 to 3577: Frame 2 of Figure 6) 333 aa:

MKNTLKSSSRFSLKQLGTGALIISSLFFGGCTTTQQDNLYTGVMSLARDSAGLEVKTA
SAGDVNLTYMERQGSDKDNAESVILLHGFSADKDNWILFTKEFDEKYHVIAVDLAG
HGDSEQLLTTDYGLIKQAERLDIFLSGLGVNSFHIAGNSMGGAISAIYSLSHPEKVKSL
TLIDAAGVDGDTESEYYKVLAEGKNPLIATDEASFEYRMGFTMTQPPFLPWPLRPSLL
RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVLD
VSAAAAFKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 6:

SEQ ID No 9: pBK1CpnEst: - the fusion of native chaperonine-coding fragments with esterase of *Oleispira antarctica* (EstRB8)

The DNA fragment coding for Cpn10 and Cpn60 is flanked by *Sac*I site (pos. 69-75) and *Sal*I site (encoded by pos. 2138-2143 of Figure 7):

Nucleotide positions 1-75 correspond to reverse complement of positions 1196-1121 and positions 5233-5273 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene)

Small letters – the Cpn10-Cpn60 encoding fragment,
Capital italics – fragments of vector pBK-CMV
Capital letters – fragment coding for EstRB8 from plasmid pBK1Est

ACAGGAAACAGCTATGACCTTGATTACGCCAAGCTCGAAATTAACCCTCACTAAAGGGA

*ACAAAAGCTGGAGCTC*ctaatacttgggatccaacagttggagagtctagcaaatgaaaatccgtccattacatgatcgtatt

gttgttcgccgtaaagaagaagagaccgcaactgcgggtggtattattttaccgggcgctgcggcagaaaaaccaaatcaaggtgttgt

tatctctgtgggtactggccgtattcttgataatggttcagtgcaagcgctggcggttaacgaaggcgatgttgtcgtttttggtaaatactc

aggtcaaaatactatcgatatcgatggtgaagaattattgattttgaatgaaagtgatatctacggcgtttttagaagcttaattattacactca

ctttttatttaacctacaaaatttaaggaaagatcatggctgctaaagacgtattatttggtgatagcgcacgcgcaaaaatgttggtaggt

gtaaacattttagccgacgcagtaagagttaccttaggacctaaaggtcgtaacgttgttatagaaaaatcatttggtgcaccgatcatcac

caaagatggtgtttctgttgcgcgtgaaatcgaattgaaagacaaattcgaaaacatgggcgcacagatggttaaggaagttgcttctca

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gcacttcgtgcgatggaagctcctatccgtcaaatcgcgggtaacgcaggtgctgaagggtcagtggttgttgataaagtgaaatctgg

cacaggtagctttggttttaacgccagcacaggtgagtatggcgatatgattgcgatggggtattttagaccctgcaaaagtcacgcgttca

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tatgcctgatatgggcggcatgggtggaatgggcggtatgcctggcatgatgtaatcactttgtgattcattgtcctgatctgcttaccgtG

TCGACATATTCAAGATAAAGATGCCTTCACTGACATCAGTCACCAACAATCAATC
AAACACCAATACCAATCGCAAAAACTCATAAAACTAGCCGATCACCAAATCCCA
AAAGCGTTCAAAAATGAAACGAGCACGTCACACAAAATCAATTTATACGCTAAC
GAACCAGGTCAAACTTATCGTTTTTTTGAGCACGTTTGTTCCACTAATGAAAGAG
AAAAGTCGTTAATTCACTGGCTTTTGGCGTATCCGCACCTTCACATAGAAATTAGT
AATGGCATGCTACTGGCCTTTAAAAAGAATCAGTTAATTGAAGAAACCTCGCTTA
TCTCAGCCATTACCGCTGTAGCCGAATTTGCGCTTATCCTCAGCCATGATTAAACT
GACGCCAATTAATATAAGACATACTAATTAATAACTCCCTTAATTGAGAAGAATA
ATGAAAAACACACTCAAATCCTCATCACGTTTTAGTCTGAAACAACTCGGCACCG
GCGCTCTGATTATCTCCAGTTTGTTCTTCGGTGGTTGCACCACAACACAACAAGAT
AATTTATACACAGGGGTTATGTCTCTTGCGAGAGACAGCGCTGGCCTAGAAGTTA
AAACAGCCTCTGCCGGTGACGTCAATCTTACTTATATGGAACGCCAAGGCAGTGA
CAAAGATAATGCCGAAAGCGTTATTTTATTACACGGTTTCTCTGCTGATAAAGAT
AACTGGATTCTTTTTACCAAAGAATTCGATGAAAAATATCATGTTATCGCTGTCGA
TTTAGCGGGACATGGCGATTCAGAACAATTATTAACGACTGATTACGGTCTCATA
AAACAAGCCGAGCGTTTAGATATCTTCTTATCTGGCTTAGGGGTTAACTCATTTCA
CATCGCCGGTAATTCAATGGGGGGGGGCTATCAGCGCAATCTACAGTTTGAGTCAC
CCAGAGAAAGTTAAAAGTCTTACATTGATCGATGCAGCAGGTGTCGATGGCGATA
CTGAAAGCGAATACTACAAAGTTTTGGCAGAAGGTAAGAATCCTTTAATTGCAAC
TGATGAAGCAAGTTTTGAATACCGCATGGGTTTCACCATGACTCAGCCTCCTTTCC
TACCTTGGCCACTAAGACCTTCTTTATTACGTAAAACGCTAGCCCGTGCCGAGATC
AATAACAAAATTTTTTCCGATATGCTGAAAACCAAAGAACGTTTAGGAATGACTA
ACTTTCAACAGAAAATTGAAGTGAAAATGGCTCAACATCCATTGCCAACACTGAT
TATGTGGGGCAAAGAAGATCGCGTTCTTGACGTATCCGCAGCAGCGGCCTTCAAA
AAAATAATTCCACAAGCAACTGTTCATATTTTTCCTGAAGTAGGCCACCTACCTAT
GGTAGAAATTCCTAGTGAAAGCGCTAAAGTTTATGAAGAGTTTTTGTCCTCTATTA
AATAAGAGCACATAATCATGACTGACTTATAAACAGCCAAGCATTTAAAATGCTT
GGCTGTTTATTTTAATGGCCAAATTATTCAACGACCAAGCTCTGCGGTAAAATCG

CAGTGGGTTTCTTGTTTTCATCAACAGCAACAAACGTGAAATACCCCGTAATCGC
ATTTTTCTGATTATCAAAATACATACTTTCCACCAGCATATTAACTTCAACTTTTA
AACTCGTCCGCCCTACCTCTATAACACTGGCAGTCAATTCGACAATGGTACCTGC
GGGAACAGGATGCTTAAAATCGATTCGATCACTGCTGACGGTTACGATGCTTTGT
CGAGAAAAACGAGTCGCTGCAATAAAAGAAACCTCATCCATCCACTGCATTGCA
GTGCCACCGAATAACGTATCATGATGATTTGTTGTCTCTGGAAATACCGCTTTAGA
AATAGTGGTTTTTGATACGCGCTTTCGCTGCGCAATAATATCTTCTCTGCTAAGAG
TTGCGGATGGCATACATAAACTCGCTTGATTAAGATTAATAATAAATAGTTAACA
GTATATTGAACTGAGGGTCTGAAGAACTCTAATACCTCTGAAGAACTTTGAGGCC
GCTAGAGAGAAAAGACCAGTGATAATATTTCATCTTGCCATGAGAGCTTATCATG
AAAGCCTGTGCTTAAAATCAATCATTATATTTATTCATCTTTAATTGAAATAATAC
CAATATATTTCATATATAATTTCACACTACCCTTATCTCACTAGACTTCCCGCGCA
TAGGCGCAAACAATCAACGCAAGTTCACAATAAAGCGGTTCGCTGCAACACATG
CCCTAGCGTCTAAAGTAGCACGCACAACACTGGCCAGTCGTACTAGCCCCTTTGC
GATTCGTGCAGACGAGCAACAAGCGCTATTAAACTTACCTAAATTTCTAACCACC
ACCATTGGTTCTTTTCCACAAACTCAAAAAACTCGTCAAATCCGCTTGCAATTTAA
ACGCGATGACATAGATCTAATCGATTATCAAACCCGCATTCAAGCGCTCATTAAA
AACGCACCACTGGCAAGAAGTTCTACCTGCACTGACCAATATGCAAGCGGCGGC
GGAAGAGCTGCCTTTGATCGATCAAGAAGAAGGGAGCAGCAAAGAGGAAAACA
ATCAAAAGAGGAGAGCAATCAAATAAAAACGAGTTATTGAGGATTTTAATTTTA
AAACAGGTATATTAATACCCTCTCTCGTAGTAAACAATGACTGTATTTACACAAA
AATAAATAGAGGTATACCATGTCAAACATCTGGTTTGAAGTACCAAAGATTGAAG
TATTAAACCGTCAAATGGAAAATACTGCCTGCAGCAACTTAGGCATTCAAATTAC
AGAAATTGGCGATGATTATATCACTGGCACAATGCCAGCAGATGCACGTACCTTC
CAGCCAATGGGACTGATTCATGGCGGCTCAAATGTATTGCTGGCAGAAACACTGG
GCAGCATGGCAGCTAACTGCTGTATTAATTTGTCTCAAGAATATTGTGTTGGCCA
AGAAATTAACGCCAACCACATACGCGGTGTTCGTTCCGGCATAGTGACTGGCACA
GCAACGCTAGTACACAAAGGAAGAACCTCCCAGATTTGGGAAATTCGCATCGTTA
ACGATCCAAGAATTCAAAAAGCTTCTCGAGAGTACTTCTAGAGCGGCCGCGGGCCCA
TCGATTTTCCACCCGGGTGGGGTACCAGGTAAGTGTACCCAATTCGCCCTATAGTGAGT
CGTATTACAATTCACTGGCCGTCGTTTTAC

Figure 7:

Amino acid sequences expressed from vector pBK1CpnSREst: - the co-expression of the stabilized single ring mutant chaperonin with the esterase gene (EstRB8) from *Oleispira antarctica* (cpn10::stabilized single ring mutant Glu460Ala/Ser462Ala/Val463Ala::est)

SEQ ID No 10: cpn10 (nucleotides 113 to 403: Frame 2 of Figure 8) 97 aa:

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEKPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

Below – **Capital bold letters** are the mutations introduced

SEQ ID No 11: stabilized single ring mutant of cpn60 (nucleotides 455 to 2098: Frame 2 of Figure 8) 548 aa:

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSVA
REIELKDKFENMGAQMVKEVASQANDQAGDGTTTATVLAQAIISEGLKSVAAGMNP
MDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKVG
KEGVITVEEGKGLEDELDVVEGMQFDRGYLSPYFINNQEKMTVEMENPLILLVDKKI
DNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGDR
RKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEASV
NTRVDQIRAEIESSTSDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVDDA
LHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQIAGN
AGA*AG**AA*VVDKVKSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASIAGL
MITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

SEQ ID No 12: EstRB8 (nucleotides 2579 to 3577: Frame 2 of Figure 8) 333 aa:

MKNTLKSSSRFSLKQLGTGALIISSLFFGGCTTTQQDNLYTGVMSLARDSAGLEVKTA
SAGDVNLTYMERQGSDKDNAESVILLHGFSADKDNWILFTKEFDEKYHVIAVDLAG
HGDSEQLLTTDYGLIKQAERLDIFLSGLGVNSFHIAGNSMGGAISAIYSLSHPEKVKSL
TLIDAAGVDGDTESEYYKVLAEGKNPLIATDEASFEYRMGFTMTQPPFLPWPLRPSLL

RKTLARAEINNKIFSDMLKTKERLGMTNFQQKIEVKMAQHPLPTLIMWGKEDRVLD
VSAAAAFKKIIPQATVHIFPEVGHLPMVEIPSESAKVYEEFLSSIK

Figure 8:

SEQ ID No 13: DNA sequence of vector pBK1CpnSREst: the expression cassette for the co-expression of the stabilized single ring mutant chaperonin with the esterase gene (EstRB8) from *Oleispira antarctica* (cpn10::stabilized single ring mutant Glu460Ala/Ser462Ala/Val463Ala::est)

Nucleotide positions 1-75 correspond to reverse complement of positions 1196-1121 and positions 5233-5273 correspond to reverse complement of 1043-952 of pBK-CMV vector (Stratagene)

DNA fragment coding for Cpn10 and Cpn60 is flanked by *Sac*I site (pos. 69-75) and *Sal*I site (pos. 2138-2143).

In the DNA sequence:

Small letters – the Cpn10-Cpn60 coding fragment,

Capital italics – fragments of vector

Capital letters – fragment coding for EstRB8 from plasmid pBK1Est

Capital bold letters = introduced mutations

ACAGGAAACAGCTATGACCTTGATTACGCCAAGCTCGAAATTAACCCTCACTAAAGGGA
*ACAAAAGCTGGAGCTC*ctaatacttgggatccaacagttggagagtctagcaaatgaaaatccgtccattacatgatcgtatt

gttgttcgccgtaaagaagaagagaccgcaactgcgggtggtattatttttaccgggcgctgcggcagaaaaaccaaatcaaggtgttgt

tatctctgtgggtactggccgtattcttgataatggttcagtgcaagcgctggcggttaacgaaggcgatgttgtcgttttttggtaaatactc

aggtcaaaatactatcgatatcgatggtgaagaattattgattttgaatgaaagtgatatctacggcgtttttagaagcttaattattacactca

ctttttttatttaacctacaaaatttaaggaaagatcatggctgctaaagacgtattatttggtgatagcgcacgcgcaaaaatgttggtaggt

gtaaacattttagccgacgcagtaagagttaccttaggacctaaaggtcgtaacgttgttatagaaaaatcatttggtgcaccgatcatcac

caaagatggtgtttctgttgcgcgtgaaatcgaattgaaagacaaattcgaaaacatgggcgcacagatggttaaggaagttgcttctca

agccaacgaccaagccggtgacggcacaacgacagcgactgtactagcacaggcgattatcagcgaaggcttgaaatctgttgcgg

ctggcatgaatccaatggatcttaaacgtggtattgataaagctacggctgctgttgttgccgccattaaagaacaagctcagccttgcttg

gatacaaaagcaatcgctcaggtagggacaatctctgccaatgccgatgaaacggttggtcgtttaattgctgaagcgatggaaaaagt

cggtaaagaaggtgtgattaccgttgaagaaggcaaaggccttgaagacgagcttgatgttgtagaaggcatgcagttcgatcgcggtt

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cttcaagagctgttgccaattcttgaaaacgtcgctaaatcaggtcgtccattattgatcgttgctgaagatgttgaaggccaagcactagc

aacattggtagtaaacaacttgcgcggcacattcaaggttgcagcggttaaagcccctggtttttggcgatcgtcgtaaagcgatgttgca

agatcttgccatcttgacgggtggtcaggttatttctgaagagctagggatgtctttagaaactgcggatccttcttctttgggtacggcaag

caaggttgttatcgataaagaaaacaccgtgattgttgatggcgcaggtactgaagcaagcgttaatactcgtgttgaccagatccgtgct

gaaatcgaaagctcgacttctgattacgacatcgaaaagttacaagaacgcgttgctaagcttgcgggcggcgttgccgtgattaaggtt

ggtgcgggttctgaaatggaaatgaaagagaagaaagaccgtgttgacgatgcacttcatgcaactcgcgcagcggttgaagaaggt

gttgttgcgggtggtggtgttgctttgattcgcgcactctcttcagtaaccgttgttggtgataacgaagatcaaaacgtcggtattgcattg

gcacttcgtgcgatggaagctcctatccgtcaaatcgcgggtaacgcaggtgctgCagggGcagCggttgttgataaagtgaaatct

ggcacaggtagctttggttttaacgccagcacaggtgagtatggcgatatgattgcgatgggtattttagaccctgcaaaagtcacgcgtt

catctctacaagccgcggcgtctatcgcaggtttgatgatcacaaccgaagccatggttgcggatgcgcctgttgaagaaggcgctggt

ggtatgcctgatatgggcggcatgggtggaatgggcggtatgcctggcatgatgtaatcactttgtgattcattgtcctgatctgcttaccg

tGTCGACATATTCAAGATAAAGATGCCTTCACTGACATCAGTCACCAACAATCAAT

CAAACACCAATACCAATCGCAAAAACTCATAAAACTAGCCGATCACCAAATCCC

AAAAGCGTTCAAAAATGAAACGAGCACGTCACACAAAATCAATTTATACGCTAA

CGAACCAGGTCAAACTTATCGTTTTTTTGAGCACGTTTGTTCCACTAATGAAAGAG

AAAAGTCGTTAATTCACTGGCTTTTGGCGTATCCGCACCTTCACATAGAAATTAGT

AATGGCATGCTACTGGCCTTTAAAAAGAATCAGTTAATTGAAGAAACCTCGCTTA

TCTCAGCCATTACCGCTGTAGCCGAATTTGCGCTTATCCTCAGCCATGATTAAACT

GACGCCAATTAATATAAGACATACTAATTAATAACTCCCTTAATTGAGAAGAATA

ATGAAAAACACACTCAAATCCTCATCACGTTTTAGTCTGAAACAACTCGGCACCG

GCGCTCTGATTATCTCCAGTTTGTTCTTCGGTGGTTGCACCACAACACAACAAGAT

AATTTATACACAGGGGGTTATGTCTCTTGCGAGAGACAGCGCTGGCCTAGAAGTTA

AAACAGCCTCTGCCGGTGACGTCAATCTTACTTATATGGAACGCCAAGGCAGTGA

CAAAGATAATGCCGAAAGCGTTATTTTATTACACGGTTTCTCTGCTGATAAAGAT

AACTGGATTCTTTTTACCAAAGAATTCGATGAAAAATATCATGTTATCGCTGTCGA

TTTAGCGGGACATGGCGATTCAGAACAATTATTAACGACTGATTACGGTCTCATA

AAACAAGCCGAGCGTTTAGATATCTTCTTATCTGGCTTAGGGGTTAACTCATTTCA

CATCGCCGGTAATTCAATGGGGGGGGGCTATCAGCGCAATCTACAGTTTGAGTCAC

CCAGAGAAAGTTAAAAGTCTTACATTGATCGATGCAGCAGGTGTCGATGGCGATA

CTGAAAGCGAATACTACAAAGTTTTGGCAGAAGGTAAGAATCCTTTAATTGCAAC

TGATGAAGCAAGTTTTGAATACCGCATGGGTTTCACCATGACTCAGCCTCCTTTCC

TACCTTGGCCACTAAGACCTTCTTTATTACGTAAAACGCTAGCCCGTGCCGAGATC

AATAACAAAATTTTTTCCGATATGCTGAAAACCAAAGAACGTTTAGGAATGACTA

ACTTTCAACAGAAAATTGAAGTGAAAATGGCTCAACATCCATTGCCAACACTGAT

TATGTGGGGCAAAGAAGATCGCGTTCTTGACGTATCCGCAGCAGCGGCCTTCAAA

AAAATAATTCCACAAGCAACTGTTCATATTTTTCCTGAAGTAGGCCACCTACCTAT

GGTAGAAATTCCTAGTGAAAGCGCTAAAGTTTATGAAGAGTTTTTGTCCTCTATTA

AATAAGAGCACATAATCATGACTGACTTATAAACAGCCAAGCATTTAAAATGCTT

GGCTGTTTATTTTAATGGCCAAATTATTCAACGACCAAGCTCTGCGGTAAAATCG

CAGTGGGTTTCTTGTTTTCATCAACAGCAACAAACGTGAAATACCCCGTAATCGC

ATTTTTCTGATTATCAAAATACATACTTTCCACCAGCATATTAACTTCAACTTTTA

AACTCGTCCGCCCTACCTCTATAACACTGGCAGTCAATTCGACAATGGTACCTGC

GGGAACAGGATGCTTAAAATCGATTCGATCACTGCTGACGGTTACGATGCTTTGT

CGAGAAAAACGAGTCGCTGCAATAAAAGAAACCTCATCCATCCACTGCATTGCA

GTGCCACCGAATAACGTATCATGATGATTTGTTGTCTCTGGAAATACCGCTTTAGA

AATAGTGGTTTTTGATACGCGCTTTCGCTGCGCAATAATATCTTCTCTGCTAAGAG

TTGCGGATGGCATACATAAACTCGCTTGATTAAGATTAATAATAAATAGTTAACA

GTATATTGAACTGAGGGTCTGAAGAACTCTAATACCTCTGAAGAACTTTGAGGCC

GCTAGAGAGAAAAGACCAGTGATAATATTTCATCTTGCCATGAGAGCTTATCATG

AAAGCCTGTGCTTAAAATCAATCATTATATTTATTCATCTTTAATTGAAATAATAC

CAATATATTTCATATATAATTTCACACTACCCTTATCTCACTAGACTTCCCGCGCA

TAGGCGCAAACAATCAACGCAAGTTCACAATAAAGCGGTTCGCTGCAACACATG

CCCTAGCGTCTAAAGTAGCACGCACAACACTGGCCAGTCGTACTAGCCCCTTTGC

GATTCGTGCAGACGAGCAACAAGCGCTATTAAACTTACCTAAATTTCTAACCACC

ACCATTGGTTCTTTTCCACAAACTCAAAAAACTCGTCAAATCCGCTTGCAATTTAA

ACGCGATGACATAGATCTAATCGATTATCAAACCCGCATTCAAGCGCTCATTAAA

AACGCACCACTGGCAAGAAGTTCTACCTGCACTGACCAATATGCAAGCGGCGGC

GGAAGAGCTGCCTTTGATCGATCAAGAAGAAGGGAGCAGCAAAGAGGAAAACA

ATCAAAAGAGGAGAGCAATCAAATAAAAACGAGTTATTGAGGATTTTAATTTTA

AAACAGGTATATTAATACCCTCTCTCGTAGTAAACAATGACTGTATTTACACAAA

AATAAATAGAGGTATACCATGTCAAACATCTGGTTTGAAGTACCAAAGATTGAAG

TATTAAACCGTCAAATGGAAAATACTGCCTGCAGCAACTTAGGCATTCAAATTAC

AGAAATTGGCGATGATTATATCACTGGCACAATGCCAGCAGATGCACGTACCTTC

CAGCCAATGGGACTGATTCATGGCGGCTCAAATGTATTGCTGGCAGAAACACTGG

GCAGCATGGCAGCTAACTGCTGTATTAATTTGTCTCAAGAATATTGTGTTGGCCA

AGAAATTAACGCCAACCACATACGCGGTGTTCGTTCCGGCATAGTGACTGGCACA
GCAACGCTAGTACACAAAGGAAGAACCTCCCAGATTTGGGAAATTCGCATCGTTA
ACGATCCAAAGAATTCAAAAAGCTTCTCGAGAGTACTTCTAGAGCGGCCGCGGGCCCA
TCGATTTTCCACCCGGGTGGGGTACCAGGTAAGTGTACCCAATTCGCCCTATAGTGAGT
CGTATTACAATTCACTGGCCGTCGTTTTAC

Figure 9:

Amino acid sequence of the stabilized single ring mutant Glu460Ala/Ser462Ala/Val463Ala of Cpn60:

SEQ ID No 14: Cpn10 (nucleotides 458-751of Figure 10):

MKIRPLHDRIVVRRKEEETATAGGIILPGAAAEKPNQGVVISVGTGRILDNGSVQALA
VNEGDVVVFGKYSGQNTIDIDGEELLILNESDIYGVLEA

SEQ ID No 15: Cpn60 (nucleotides 458-751 of Figure 10):

MAAKDVLFGDSARAKMLVGVNILADAVRVTLGPKGRNVVIEKSFGAPIITKDGVSVA
REIELKDKFENMGAQMVKEVASQANDQAGDGTTTATVLAQAIISEGLKSVAAGMNP
MDLKRGIDKATAAVVAAIKEQAQPCLDTKAIAQVGTISANADETVGRLIAEAMEKVG
KEGVITVEEGKGLEDELDVVEGMQFDRGYLSPYFINNQEKMTVEMENPLILLVDKKI
DNLQELLPILENVAKSGRPLLIVAEDVEGQALATLVVNNLRGTFKVAAVKAPGFGDR
RKAMLQDLAILTGGQVISEELGMSLETADPSSLGTASKVVIDKENTVIVDGAGTEASV
NTRVDQIRAEIESSTSDYDIEKLQERVAKLAGGVAVIKVGAGSEMEMKEKKDRVDDA
LHATRAAVEEGVVAGGGVALIRALSSVTVVGDNEDQNVGIALALRAMEAPIRQIAGN
AGAAGAAVVDKVKSGTGSFGFNASTGEYGDMIAMGILDPAKVTRSSLQAAASIAGL
MITTEAMVADAPVEEGAGGMPDMGGMGGMGGMPGMM

Figure 10:

SEQ ID No 16: DNA sequence of the stabilized single ring mutant
Glu460Ala/Ser462Ala/Val463Ala:

In the DNA sequence:

Small letters – the Cpn10-Cpn60 coding fragment,

Big bold letters = introduced mutations

atcaaaaaatgcagcaaggacagattcctgcccaagaattagcagaaggtttcttgttagcactggccggcgcctttattattaacgccgg

gttttgtcactgatgcgctgggttttacattactcgtccccgcgacgcgtaaagcgttggtccataaggtgattgcatttattacccctc

gcatgatgactgcaagcagctttcaagcgacgggtagttttcaggaaggctcgtttaaagatgtacattcgcacactgactcgcaaagca

gtcatgaaaaaatcacaattgaaggcgaatataccaaagacgataagtaggtattttttcggctagccgttgaaatcctagtaaaagccc

cgataaattaaccatctattttcacagaggcaatttagcctttgtttaccttattgatcctaatacttgggatccaacagttggagagtctagc

aaatgaaaatccgtccattacatgatcgtattgttgttcgccgtaaagaagaagagaccgcaactgcgggtggtattattttacc

gggcgctgcggcagaaaaaccaaatcaaggtgttgttatctctgtgggtactggccgtattcttgataatggttcagtgcaagcgctggc

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aagtgatatctacggcgttttagaagcttaattattacactcacttttttatttaacctacaaaatttaaggaaagatcatggctgctaaagacg

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tactagcacaggcgattatcagcgaaggcttgaaatctgttgcggctggcatgaatccaatggatcttaaacgtggtattgataaagctac

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tggcgcaggtactgaagcaagcgttaatactcgtgttgaccagatccgtgctgaaatcgaaagctcgacttctgattacgacatcgaaaa

gttacaagaacgcgttgctaagcttgcgggcggcgttgccgtgattaaggttggtgcgggttctgaaatggaaatgaaagagaagaaa

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cggtatgcctggcatgatgtaatcactttgtgattcattgtcctgatctgcttaccgtgtaaaaagatcaggctcaaggctgtctctataaaa

agccgtatctttgatgagtgttgtctttctgctgaaaacgacattcttggagtgcggcttttttttgattttggtcataaaattcagaatattgtgta

attttatgtaactagctggcctataatgttgagttcctctgggtggcatgatctcatggtacttcacttaagcctgattcactgcg

gctttaacagtaaaataataacgcaacgtagaaacataataagcgtatggcattaatgaagacggctgcatttaattcagatc